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RONALD E. DeLUGA

Mechanical Engineer

DSN 787-3362
Commercial: (513) 257-3362

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Design of a Family of Munitions Containers (FMC)
Overall Project Management

of

FMC #1 (CNU 532/E),

FMC #2 (CNU 533/E),

&

FMC #3 (CNU 534/E, CNU 335 B/E, CNU 336 B/E, & CNU 505/E)

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AFMC-LSO/LGTP
AIR FORCE PACKAGING EVALUATION ACTIVITY
5215 THURLOW STREET
WRIGHT PATTERSON AFB, OH 45433-5540
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AFPEA PROJECT NO. 89-P-146

TITLE: Design of a Family of Munitions Containers, the Overall Project
Management of FMC #1, FMC #2, and FMC #3


ABSTRACT

An OO-ALC/MMW (presently OO-ALC/LIWDT) Process Action Team (PAT) came up with the idea to have a Family of Munitions Containers (FMC) of three to six containers to replace most of the Air Force's 200 munitions containers. OO-ALC realizing the potential of this idea initiated Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. The development of the Family of Munitions Containers was initially centered around five contains with internal volumes of 0.014 M³ (0.5 ft³), 0.078 M³ (2.75 ft³), 1.005 M³ (35.5 ft³), 1.657 M³ (58.5 ft³), and 3.051 M³ (107.75 ft³). AFPEA was to design the three smallest containers, and they have been designated FMC #1, FMC #2, and FMC #3, from smallest to largest. The remaining two largest containers will either use current aluminum containers or be designed at a later date.

The three containers are designed to meet a tailored version of MIL-C-5584. The requirements in this tailored version meet as many of the users needs as possible. The tailored specification is titled "Design Criteria for a Family of Munitions Containers," and sets down the requirements for each of the containers. FMC #1 (CNU 532/E) is designed to a maximum gross weight of 19.1 Kg (42.0 Lb.), FMC #2 (CNU 533/E) is designed to a container gross weight of 68.2 Kg (150.0 Lb.). These two containers were designed to weight criteria because no specific item was chosen to be packaged. However, FMC #3 (CNU 534/E, as the empty configuration) was designed to hold specific items. It was designed for either 12 BSU/49s (CNU 335B/E), or 2 BSU/50s (CNU 336B/E), or 6 MXU/650s with supporting materials (CNU 505/E). The only requirement is that you package each set of bomb fins with a different set of cushioning/dunnage, thus the different CNU numbers.


MAN-HOURS: 1800

PREPARED BY:


Ronald E DeLuga
Mechanical Engineer
AF Packaging Eval. Activity

PUBLICATION DATE: 09 Jan 95

REVIEWED BY:


TED HINDS
Chief, Container Design
and Engineering
AFPEA

APPROVED BY:

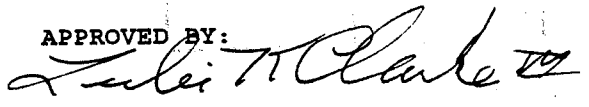

Leslie K, Clarke III
Chief, Air Force
Packaging Evaluation
Activity

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INTRODUCTION:

REFERENCES:

Any of the referenced reports, listed below, may be obtained from the Air Force Packaging Evaluation Activity (AFPEA), AFMC LSO-LOP/LGTP (formerly HQ AFMC/LGTP), 5215 Thurlow Street, Wright-Patterson AFB, Ohio 45433-5540 DSN 787-3362 or Commercial (513) 257-3362.

1. Family of Munitions Container #1 (FMC #1) Final Report
AFPEA Report No. 94-R-08
AFPEA Project No. 90-P-125
2. Family of Munitions Container #2 (FMC #2) Final Report
AFPEA Report No. 94-R-01
AFPEA Project No. 91-P-101
3. Family of Munitions Container #3 (FMC #3) Final Report
AFPEA Report No. 94-R-10
AFPEA Project No. 90-P-122

BACKGROUND:

An OO-ALC/MMW (presently OO-ALC/LIWD) Process Action Team (PAT) came up with the idea to have a Family of Munitions Containers (FMC's) of three to six containers to replace most of the Air Force's 200 munitions containers. OO-ALC realizing the potential of this idea initiated Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. The development of the Family of Munitions Containers was initially centered around five containers with internal volumes of 0.014 M³ (0.5 ft³), 0.078 M³ (2.75 ft³), 1.005 M³ (35.5 ft³), 1.657 M³ (58.5 ft³), and 3.051 M³ (107.75 ft³). AFPEA was to design the three smallest containers, and they have been designated FMC #1, FMC #2, and FMC #3, from smallest to largest. The remaining two largest containers will either use current aluminum containers or be designed at a later date.

The three containers are designed to meet a tailored version of MIL-C-5584, Containers, Shipping & Storage, Metal, Reusable. The requirements in this tailored version meet as many of the users needs as possible. The tailored specification is titled "Design Criteria for a Family of Munitions Containers" (Appendix 1). This document sets down the requirements for each of the containers. FMC #1 (CNU 532/E) is designed to a maximum item weight of 19.1 Kg (42.0 Lb.), FMC #2 (CNU 533/E) is designed to a container gross weight of 68.2 Kg (150.0 Lb.). These two containers were designed to weight criteria because no specific item was chosen to be packaged. However, FMC #3 (CNU 534/E as the empty configuration) was designed to hold three specific items. It was designed for either 12 BSU/49's (CNU 335B/E), or 2 BSU/50's (CNU 336B/E), or 6 MXU/650's with supporting materials (CNU 5050/E). The only change to FMC #3 is that you package each set of bomb fins with a different set of

cushioning/dunnage. The external container configuration is the same (CNU 534/E).

These requirements were determined by AFPEA and OO-ALC/LIWDT. The requirements were arrived at after significant research which included meeting with the users at the base level (OO-ALC and HQ AFCOMAC/LGW, the Munitions School). These base level meetings included personnel that ranged in rank from Airman to Chief Master Sergeant, officers, and civilians all who worked with or in support of the types of munitions that will be packaged in the Family of Munitions Containers. Other meetings that helped to shape the requirements documentation for this project were Preliminary and critical Design Reviews and a full design presentation at the World Wide Munitions Conference to over 100 munitions personnel.

Some of the examples of design items that were added to requirements list or changed on the containers follow. First FMC #1 had a pressure relief valve add so that the containers would not have to be opened before air shipment and closed after shipment, thus reducing manpower significantly. A second example is that the ends of the extrusions for FMC #2 were opened up to alleviate the users concerns over troubles with decontamination, clean out of pests or other debris after a quarantined shipment scenario. These are just two examples of the types of items that the users commented on in order to improve the requirements document for the FMC project.

REQUIREMENTS:

AFPEA in union with OO-ALC/LIWDT developed a Statement of Work (SOW) for the design of the FMC's. This SOW was developed by tailoring MIL-C-5584, Military Specification, Containers, Shipping and Storage, Metal, Reusable. The SOW, titled The Design Criteria for Family Group of Munitions Containers is attached in Appendix 1 and defines all of the criteria and requirements for the container designs.

DESIGN:

CONFIGURATION:

The Family of Munitions Containers are aluminum shipping and storage containers. The containers are all fabricated from aluminum extrusions and contain many of the same or similar features. Some of these similar features are; cam-over-center latches, a pressure relief valve, air filling valve, and a silicone rubber gasket, integral stacking features, personnel handles for either lifting the lid or the entire container. All three of the containers are designed using bare unpainted aluminum with no extra finish. This cuts costs in painting and maintaining the container and reduces any adverse environmental impact caused by painting. This removal of paint from the surface of aluminum containers is one of several by products of

the Family of Munitions Containers project. The specific design configurations of each container can be found in their respective final project reports.

TESTING:

TEST SPECIMENS:

AFPEA fabricated two prototype containers of each configuration in house for testing. The prototype containers were fabricated IAW all the requirements and tolerances of the container drawing package(s). The same drawing package(s) that will be released to OO-ALC/LIWDT for the manufacture of production quantities of the container(s). The specific drawing/data packages are the FMC #1 (CNU 532/E), FMC #2 (CNU 533/E), and FMC #3 (CNU 534/E, CNU 335B/E, CNU 336B/E, and CNU 505/E,).

TEST PLANS:

The test plan(s) was designed, (IAW the Design Criteria for Family Group of Munitions Containers, MIL-C-5584, MIL-STD-648 and FED-STD-101), to qualify each of the container configuration for transportation and storage in a world-wide environment. The only deviation from the original design criteria, Appendix 1, has been for the pressure or leak tests for the small container, FMC #1. This deviation was approved by OO-ALC/LIWDT and has been incorporated into the test plan for FMC #1. The approval for the new leak rate applies only to FMC #1 and is specifically due to the small volume of the container. The justification for the use of this deviation from the original design criteria is contained in the AFPEA Report # 94-R-08, Development of the Family of Munitions Container #1. The test plans include all test procedures, test equipment, and pass/fail performance criteria for conducting complete qualification testing. To see the specific test plans, reference the final project report for the specific configuration of interest.

RESULTS:

The specific results of all testing can be found in the final report of the configuration of interest. In summary, the testing of FMC #2 and FMC #3 was completely successful. They passed the test plan and are fully qualified shipping and storage container. FMC #1 did not completely pass the original test plan. There were two anomalies that occurred during the testing of FMC #1. First, the leak rate was changed due to the small size of the container, see the appendix 2 of the FMC #1 final report, AFPEA Report # 94-R-08. Secondly, the repeatability and reliability of the gasket seal came into question. Several items were changed/modified which improved the overall reliability of the seal. However, this improvement was not complete and therefore the reliability of the seal on FMC #1 is not 100%, see the final report for FMC #1. Therefore FMC #1 was not qualified as a sealed container. The factors that influenced this are its small

size, the gasket/lid/base interface AFPEA is currently working on a Defense Ammunition Packaging Council (DAPC) Project on aluminum and aluminum extrusion technology. This project includes the improvement of the design of small munitions containers. AFPEA has taken many of the lessons learned from FMC #1 and started to incorporate them into the DAPC small munitions container. AFPEA is working on a new small container of the same size, when this DAPC project is completed the information will be forwarded to OO-ALC/LIWDT so they have the highest quality and completely qualified small munitions container possible.

CONCLUSION:

With the completion of the FMC project, AFPEA has provided OO-ALC/LIWDT with all the necessary information to procure and enter into the Air Force inventory all three of the smaller Family of Munitions Containers. This information includes providing the complete data package to both OO-ALC/LIWDT and the data repository at OO-ALC. This information is all that is necessary for complete procurement of any one of the six FMC configurations developed by AFPEA during Family of Munitions Containers PRAM project. However, this should be only the start of the Family of Munitions Container project. Because without the support of the using groups like the Item Managers and the Procurement Officials these new containers can not be entered into the inventory in large enough numbers to make an impact. It is imperative that those in a position to procure these types of items be convinced of the merits of the Family of Munitions containers and that as many of the new munitions purchased be placed in the newly designed containers. Then and only then does this project have a chance to be fully successful.

APPENDIX 1
DESIGN CRITERIA
FOR
FAMILY OF MUNITIONS CONTAINERS

28 Aug 91

DESIGN CRITERIA

FOR

A FAMILY OF MUNITIONS CONTAINERS

1. The Air Force Packaging and Evaluation Agency (AFPEA) will design three specific containers following the applicable military standards for container design requirements as well as user and program manager in puts. The below listed sizes have been determined by the program manager along with specific design specifications as listed in the following paragraphs.

INTERNAL DIMENSIONS

SIZE	LENGTH	WIDTH	HEIGHT	ITEM MAX WEIGHT
1	12	8	9	25 lb.
2	20.5	16.5	14	150 lb. CNTR GROSS WT.
3	49	38	33	675 lb.
* 4	100	39	26	2,000 lb.
** 5	180	45	23	Unknown

* Use CNU-411/E for this container.

** Use the new AUR missile container.

2. These containers will be designed for the maximum load weight and/or items in each container as indicated:

SIZE	ITEM
1	Design to maximum content weight.
2	Design to maximum content weight.
3	BSU 49/50 and MXU 650 Airfoil Group.
4	Use CNU-411 container for CBU 87/89, SUU 30-type, Mk 20, and similar type/size CBU munitions.
5	Use CNU 407 type container for all present and or future air to air missiles or other air munitions.

3. The Family of Munitions Containers shall be designed in accordance with MIL-C-5584D and options in MIL-C-5584.

A. Par. 1.2; Classification.

Sizes 1, 2, 4, and 5 Type II - Horizontal Mount

Size 3 Type I - Vertical Mount

B. Par. 3.2; First article. One container of each size (1, 2, and 3) shall be provided for first article testing, for each container design. A second container of each design shall be provided after completion of first article testing.

C. Par. 3.4; Design and construction. These containers shall be designed in metric units in accordance with Public Law 94-168, as amended by Public Law 100-418.

D. Par. 3.4.2.2; Cure date on shock isolation system. This applies to rubber products only.

E. Par. 3.4.3.1; Desiccant receptacle. Container sizes 2 and 3 shall have desiccant receptacles. Container 1 would not have a desiccant receptacle because of its small size. If required, desiccant can be placed inside container 1 by removing the cover then resealing.

F. Par. 3.4.3.2; Humidity indicator. A humidity indicator shall be provided on sizes 2 and 3. Note: A humidity indicator card may always be placed inside container size 1.

G. Par. 3.4.3.3; Pressure equalizing valve. All containers shall have a pressure relief/equalizing valve, with the following characteristics:

Cracking Pressure = 1.0 to 1.5 PSID
Full Open Pressure = 2.5 PSID
Reseal Pressure \geq 0.5 PSID

Minimum Flow Rate (cubic feet/minute) = $V_c * (0.12)$
 V_c = Volume of the Container (cubic feet)
Ref. MIL-V-27166, Par. 3.6.3

H. Par. 3.4.3.4; Visual inspection ports. N/A

I. Par. 3.4.3.5; Air filling valve. An air filling valve will be provided on containers 1, 2, and 3.

J. Par. 3.4.3.6; Record receptacle. N/A

K. Par. 3.4.3.7; Drain plug. N/A

L. Par. 3.4.3.8; Fuel leak detector. N/A

M. Par. 3.4.4; Handling provisions. Investigate the use of spring loaded handles on container 1.

N. Par. 3.6.1; Item testing/inspection. N/A

O. Par. 3.6.2; Item uploading. N/A

P. Par. 3.6.3; Installation time. N/A

Q. Par. 3.6.5; Shock transmission. Container 3, BSU 49, 50 and MXU 650 fins, require physical and mechanical protection only. The other container designs require testing to the maximum weight, therefore, shock transmission is not a concern.

R. Par. 3.6.5.1; UN drop test. Container sizes 1 and 2 shall be tested to category A, at the maximum weight, unless actual items are used.

S. Par. 3.6.8; Size and weight. The containers shall be designed to the internal sizes and for the weights specified in paragraphs 1 and 2 above.

T. Par. 3.9.1; Aluminum. The container shall be treated as defined in 1 below. An alternate method of finishing aluminum products shall be as specified in 2 below.

(1) The exterior of the container shall be bead blasted with plastic media. NOTE: this is pending MAJCOM's approval.

(2) The painting of aluminum shall be as follows:

Aluminum surfaces shall be cleaned, pretreated, primed and painted in accordance with MIL-STD-171E. Cleaning shall be in accordance with Finish 5.2, MIL-STD-171E. The container shall have an immersion cleaning in accordance with TT-C-490C(1); Method III, Type III, then rinsed, followed by a force drying. This shall be followed by a spray application of wash primer DOD-P-15328D(1). Priming and finish shall be in accordance with Finish 20.9, MIL-STD-171E, see Section 5.3 of MIL-STD-171E. The primer used shall meet the requirements of MIL-P-23377F, followed with two (2) coats of topcoat TT-E-515A(1).

U. Par. 3.12; Installation instructions. N/A

V. Par. 4.7.7.1 & 4.7.7.2; Vibration tests will not be conducted unless the actual/dummy load is being tested. When testing to a maximum weight per container vibration tests will not be required.

W. Para. 4.7.5.2; Latch strength for containers 1 and 2 shall be 500 lb.

APPENDIX 2
DISTRIBUTION LIST

DISTRIBUTION LIST

DTIC/FDAC CAMERON STATION ALEXANDRIA VA 22304-6145	1
HQ AFMC/LG WRIGHT-PATTERSON AFB OH 45433-5006	1
AFMC-LSO/LGT WRIGHT-PATTERSON AFB OH 45433-5006	1
AFMC-LSO/LGTP (LIBRARY) WRIGHT-PATTERSON AFB OH 45433-5540	10
HQ USAF/LGTT WASHINGTON DC 20330	1
654 ABG/LGT 7701 SECOND ST, STE 209 TINKER AFB OK 73145-9100	1
654 ABG/LGTP 7701 SECOND ST, STE 209 TINKER AFB OK 73145-9100	1
649 ABG/LGT BLDG 1135 7973 UTILITY DR HILL AFB UT 84056-5713	1
649 ABG/LGTP 7530 11th ST HILL AFB UT 84056-5707	1
651 ABG/LGT BLDG 1530 410 JACKSON RD KELLY AFB TX 78241-5312	1
651 ABG/LGTP 401 WISON BLVD KELLY AFB TX 78241-5340	1
652 ABG/LGT 1961 IDZOREK ST MCCLELLAN AFB CA 95652-1620	1
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653 ABG/LGT BLDG 376 455 BYRON ST ROBINS AFB GA 31098-1860	1

DISTRIBUTION LIST (Cont'd)

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ASC/AWL WRIGHT-PATTERSON AFB OH 45433	1
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ASC/YJA 110 WACISSA RD SUITE 15 EGLIN AFB FL 32542-5313	1
GSA OFFICE OF ENGINEERING MGT PACKAGING DIVISION WASHINGTON DC 20406	1
COMMANDER ATTN: N KARL (SUP 045) NAVAL SUPPLY SYSTEMS COMMAND WASHINGTON DC 20376-5000	1
COMMANDER ATTN: E PANIGOT (AIR 41212A) NAVAL AIR SYSTEMS COMMAND WASHINGTON DC 20361	1
COMMANDER ATTN: T CORBE (CODE 8218) SPACE AND NAVAL WARFARE SYSTEMS COMMAND WASHINGTON DC 20360	1
ATTN: C MANWARRING (FAC 0644) NAVAL FACILITIES ENGINEERING COMMAND HOFFMAN BLDG 2 ROOM 12S21 ALEXANDRIA VA 22332	1
COMMANDING OFFICER ATTN: K POLLOCK (CODE 15611K) NAVAL CONSTRUCTION BATTALION CENTER PORT HUENEME CA 93043	1
COMMANDER NAVAL SEA SYSTEMS COMMAND ATTN: G MUSTIN (SEA 66P) WASHINGTON DC 20362	1

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ATTN: F SECHRIST (CODE 0541) NAVY SHIPS PARTS CONTROL CENTER PO BOX 2020 MECHANICSBURG PA 17055-0788	1
COMMANDING OFFICER ATTN: F MAGNIFICO (SESD CODE 9321) NAVAL AIR ENGINEERING CENTER LAKEHURST NJ 08733-5100	1
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US AMC PACKAGING STORAGE AND CONTAINERIZATION CENTER/SDSTO-TE-E 16 HAP ARNOLD BLVD TOBYHANNA PA 18466-5097	1
DLSIE/AMXMC-D US ARMY LOGISTICS MGT CTR FT LEE VA 23801-6034	1
ATTN: Mike Ivankoe US ARMY ARDEC/SMCAR-AEP DOVER NJ 07801-5001	1
US ARMY NATICK LABS/STRNC-ES NATICK MA 01760	1
HQ AFMC/LGSH WRIGHT-PATTERSON AFB OH 45433	1
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2750 TRANS/DMTT WRIGHT-PATTERSON AFB OH 45433-5001	1
HQ PACAF/LGTT HICKAM AFB HI 96853-5000	1
HQ USAFE/LGTT APO NEW YORK 09094-5000	1
HQ ACC/LGTT LANGLEY AFB VA 23665-5001	1
HQ AFSPACECOM/LKT PETERSON AFB CO 80914-5000	1
HQ ANGSC/LGTT ANDREWS AFB MD 20331-6008	1
HQ ATC/LGTT RANDOLPH AFB TX 78150-5001	1
HQ AU/LGTT MAXWELL AFB AL 36112-5001	1
HQ AMC/XONC SCOTT AFB IL 62225-5001	1
SCHOOL OF MILITARY PACKAGING TECHNOLOGY ATSZ-MP ABERDEEN PROVING GROUND MD 21005-5001	1
HQ USMC (CPP-2) WASHINGTON DC 20380	1
ATTN: DGSC/QED DEFENSE GENERAL SUPPLY CENTER 8100 JEFFERSON DAVIS HIGHWAY RICHMOND VA 23297-5000	1

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ATTN: THEO COX OO-ALC/LIWDT 633 ELM LN HILL AFB UT 84056-5819	3
ATTN: MAJ GREG POWELL ASC/SMT WRIGHT-PATTERSON AFB OH 45433	2
HQ AFCOMAC/LGW SIERRA ARMY DEPOT CA 96113	1

APPENDIX 3
REPORT DOCUMENTATION

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
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